A Systematic Review on the Effectiveness of Biological Larvaside the Vector Control Efforts in Dengue Fever Disease

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EXTENDED ABSTRACT

A Systematic Review on the Effectiveness of Biological Larvaside the Vector Control Efforts in Dengue Fever Disease

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SUMMARY

The use of temephos as larvasida in the prevention of the disease dengue fever in Indonesia has already lasted for 40 years. Currently the most widely used larvacide for controlling Aedes sp larvae is 1% temephos. The use of insecticides for a long time for the same targets provides unmatched pressure, which encourages the development of the population of Aedes aegypti to Become more resistant faster. One effort to overcome this problem is to find a more selective and safe biological insecticide. Biological insecticides are interpreted as an insecticide whose basic ingredients come from plants that Contain chemicals (bioactive) that are toxic to insects but are biodegradable in nature, so they do not pollute the environment and are relatively safe for humans, besides biological insecticides are also selective.

Keywords: Biological larvaside, Vector control, *Aedes aegypti*

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INTRODUCTION

Dengue hemorrhagic fever (DHF) is a vector-borne disease caused by the Dengue virus of the genus Flavivirus, family of Flaviviridae. DHF is transmitted to humans through the bite of the Aedes sp mosquito infected with the dengue virus [1,2].

Drugs and vaccines to prevent dengue fever have yet to be found. One way to control the disease is to control the vector by deciding the life cycle of the mosquito using larvacide and insecticide. Currently the most widely used larvacide for controlling Aedes larvae is 1% temephos (Abate). The use of insecticides for a long time for the same targets provides unmatched pressure, which encourages the development of the population of Aedes aegypti to become more resistant faster [3,4].

There are four vector control methods, one of which is a method of biological control using natural ingredients [23]. The use of plants to control insect pests has been widely used by traditional communities of antiquity [24]. As with Lemongrass oil has many widely used as insect repellent with secondary metabolites it generates. Based on this, larvasida is a natural for this much attention of researchers to continue to develop research-based insecticides that can be used as a controller of the vector Aedes aegypti. Vegetable insecticides currently has many contribute meaningfully to a new alternative in improving public health, especially in the decrease in the number of diseases that many posed by vector mosquito [12,26].

Indonesia has a very diverse flora, contain pretty much the type of vegetation that is the source of the material the insecticides can be used to control vector. The purpose of writing this article is to examine the diversity of plants in Indonesia that have been tested as larvicides Aedes that gives an overview of research results, and follow-up for implementing vector control programs.

MATERIALS AND METHODS

Journal Articles were identified through online databases, searching engines. All unrelated studies were excluded, and duplicated studies removed. The remaining Journal Articles were reviewed restaurants one by one in full text. The inclusion criteria applied for eligibility assessment of full-text Articles were: study the method of extraction plants, a compound that contained vegetable Also the effectiveness of larvicides against the death of the larvae. and published between January 2008 and December 2016. Reviews These plants Contain essential oils, saponins and flavonoids, the which are effective as larvacides.

RESULTS

After the screening process, only 10 journal articles were selected as shown in Table I and Table II

To measure the toxicity level of a compound can be used some measurements, namely LC50 (Lethal

Table I: Types of plants tested As larvicides and the content of its compounds are on various Research

Reference	Plant name	Part used	Compounds	Effectiveness in the control of Aedes sp (Vector DHF)
[5]	White Turmeric (*Curcuma zedoaria*)	rhizome	Essential oil	Effective as larvicides
[6]	Trees Tanjung (*Mimusops Elengi L.*)	rod	Alkaloids, tannins, saponins	Effective as larvicides
[7]	Jatropha (*Jatroph a curcas*)	Seed	piperine	Effective as larvicides
[8]	Cloves (*Syzygium aromaticum L*)	Leaf	eugenol, saponins, flavonoids and tannin	Effective as larvicides
[9]	Kaffir Lime (Citrus hystrix)	Leaf	Essential oils, flavonoids, saponins, and terpenes	Effective as larvicides
[9]	Lime (Citrus amblycarpa)	Leaf	Essential oil	Effective as larvicides
[9]	Pomelo (Citrus Maxima)	Leaf	Essential oil	Effective as larvicides
[10]	Beet (Beta vulgaris L)	Fruit	Flavored alkaloids, sterols, triterpenes, saponins and tannins	Effective as larvicides
[11]	Betel (Piper betle Linn.)	Leaf	Tannins, saponins, alkaloids, polyphenols and flavonoid	Effective as larvicides
[12]	Fragrant pandan (Pandanus amaryllifolius (Roxb)	Leaf	alkaloids, saponins, flavonoids, tannins, and polyphenol	Effective as larvicides
[13]	Aloe Vera (Aloe vera)	Leaf	saponin, flavonoids, tannins	Effective as larvicides
[14]	Legundi (Vitex trifolia)	Leaf	saponins, flavonoids and alkaloids, Essential meek	Effective as larvicides

Table II : Plant name and Extraction Methods Used in Various Research

Plant name	The extraction method	The effectiveness of Substance For Vector Control DBD
White Turmeric (*Curcuma zedoaria*)	Distillation / evaporation	Essential oil potential as larvicides because it is known to be toxic in a wide pH range, stable to light and heat, and do not form a permanent coating on the surface of the water for a long time[5].
Trees Tanjung (*Mimusops Elengi L.*)	Reflukd and fractionation	Hexane proved to be the most active extracts due kills 100% of larvae at concentrations less than 100 ppm for 24 hours[6].
Jatropha (*Jatroph a curcas*)	Oil Seeds Jatropha obtained from *Surfactant and Bio-energy The research Center (SBRC) IPB Bogor*	The active compounds are suspected as larvicidal Aedes aegypti is piperine is an alkaloid class of piperidine[7].
Cloves (*Syzygium aromaticum L.*)	Percolation (the leaves are dried then crushed and extracted)	Saponins, flavonoids and tannins in clove leaf extract act as larvicides against Aedes aegypti. Through the mechanism of cell membrane damage or interfere with the metabolic processes of larvae and as stomach poisoning[8].
Kaffir Lime (*Citrus hystrix*), Lemons oranges (*Citrus amblycarpa*) and Pomelo (*Citrus Maxima*)	Dried leaves for 1 month and then made powder. The powder is then macerated with methanol and evaporated	Saponins in the extracts were swallowed by the larvae of Ae. aegypti can irritate the digestive tract mucosal larvae of Ae. aegypti and Ae larvae damage the cell membrane. aegypti. Limonoid which is an essential oil in orange can lead to a loss of coordination of the larva Ae aegypti larvae[9].
Beet (*Beta vulgaris L*)	Milled and dried fruit pulp to form a powder. The powder was extracted by percolation method. Extract Concentrated with using evaporator	Phenol, alkaloids, flavonoids, saponins, sterols and triterpenes in fruit extracts Beet (*Beta vulgaris L.*) together and cause death in larva Ae aegypti[10]
Betel (*Piper betle Linn.*)	Powder	The toxic polyphenols, tannins, flavonoids, essential oils, saponins and alkaloids when contact with the larvae will damage the mucosa of the skin and enter the body cavity[11].
Fragrant pandan (*Pandanus amaryllifolius Roxb.*)	How research work started from making fragrant pandan leaf extract by percolation	Alkaloids, saponins, flavonoids, tannins, and polyphenols. Saponins can damage cell membranes and interfere with the metabolism of the larvae while polyphenols as larvae digestive inhibitor[12].
Aloe Vera (*Aloe vera*)	-	Saponins and flavonoids, which are compounds of plant defenses that can be Inhibit larval digestive tract and also is taxed[13].
Legundi (*Vitex trifolia*)	Preparation of test solutions in the form of using the leaf Legundi extract (Vitex trifolia) and solvent in the manufacture of test solutions in the form of 96% ethanol and extraction by maceration to obtain a concentration of 100%. then extract Legundi leaf is diluted using distilled water so as to get the concentration of the extract.	Saponins, flavonoids, and alkaloids are toxic substances for larvae resulting in test larvae deaths[14].
Neem (*Azadirachta Indika A.Juss*)	Extraction is done by maceration method using ethanol solvent	Components of compounds that are organic acids that are hexanecolic acid, stearic acid, oleic acid, ethyl oleate, oktadecanoic acid, ethyl octadecanoate, Dioktil heksadioat. It is suspected that the above compounds are antilaracids against the Aedes aegypti mosquito larva[15].

Concentration 50%), LD50 (Lethal Dose 50%) and ED50 (Efective Dose 50%). LC50 is a concentration that can lead to death of 50% of animal experiments during a certain time. LD50 is the dose required to kill 50% of test organisms. ED50 is a dosage of 50% of test organisms exposing real activits effects. A crop or insulating result is considered to exhibit toxicity activity when it has a small LC50 value of 1000 ppm, whereas for pure compounds it is considered to exhibit toxicity activity if it has a small LC50 value of 200 ppm [15].

Table III : Effective Dose Some Laravasida Biological For Vector Control DBD At Some Research [5, 6,7,8,9,10,11,12,13,14,15]

Plant name	Total samples	Total repeat	LC50 (24 Hours)	LC95 (24 hours)
White Turmeric (*Curcuma zedoaria*)	25	4	54.5 ppm	
Trees Tanjung (*Mimusops Elengi L.*)	10	3	59.36 ppm	
Jatropha (Jatropha curcas)	25	5	1507 ppm	
Cloves (*Syzygium aromaticum L.*)	25	4	400 ppm	
Kaffir Lime (*Citrus hystrix*)	20	5		3,176
Lemons oranges (*Citrus amblycarpa*)	20	5		4174
Pomelo (*Citrus Maxima*)	20	5		6,369
Beet (*Beta vulgaris L*)	25	3		
Betel (*Piper betle Linn*)	20	5	314.4 ppm	
Fragrant pandan (*Pandanus amaryllifolius Roxb*)	25	4	9000 ppm	
Aloe Vera (*Aloe vera*)			10000 ppm	
Legundi (*Vitex trifolia*)	25	4	8370 ppm	
Neem (*Azadirachta Indika A.Juss*)	10	1	282.29 ppm	

Description: The LC 50 is the concentration of an insecticide (usually in food, air or water) to kill 50% of the experimental animals. LC 50 is usually expressed in mg/L or mg/insects. The smaller the value of LD50 or LC 50, the more toxic the insecticide. Animals used to determine the value of the toxicity of insecticides usually mammals such as mice.

Following table III The description of the effective dose of some of the biological larvacide research results for the control of DBD vector.

DISCUSSION AND CONCLUSION

These plants above average contains essential oil compounds, saponins and flavonoids. Saponin is a surface active compound and is soap-like, and can be detected based on its ability to form a foam if shaken in water and hams blood cells [17]. Saponins can damage cell membranes and interfere with the metabolism of insects while polyphenols as inhibitors of insect digestive. Some saponins work as an antimicrobial. Saponins work as an antibacterial to destabilize the bacterial cell membranes causing cell bakterilisis [18].

Flavonoids are known to have antioxidant activity and teratogenic substances. Flavonoids play an important role in forming pigment plant as yellow, red or blue on the petals. Flavonoids also have antimicrobial activity and insecticidal [19].

Extraction is the most common terms to obtain a compound derived from a mixture obtained from the contact between the solvent with dissolved compounds in the material that we wanted. Solvent mixture with the compound may be solids or liquids, and a variety of techniques and measuring instruments used for different situations. Inorganic chemical synthesis, reaction continuously produced is in the form of a solution or suspension form. When stirring the mixture of water with an organic solvent, the resulting product was transferred to the solvent coating and may be repeated with the evaporation of the solvent. Variety is certainly the right extraction depends on the texture and water content of the material extracted plant material on the types of compounds isolated. Generally, we need to kill the plant tissue to prevent the enzymatic oxidation or hydrolysis. Submerge the fresh leaves or flower network, if necessary, cut into pieces, into the boiling methanol is a good way to achieve that goal. Alcohol, in any way is a good solvent for the extraction preliminary versatile. Furthermore, the material can be macerated in a grinder, and then filtered. But this is utterly inconceivable only required if we want to extract out [20].

Maceration is a crude drug screening process using a solvent with soaking and some time shaking or stirring at room temperature (room). It will penetrate the cell wall and into the cavity of cells containing an active substance that will dissolve, because of differences in the concentration of a solution of the active substance in the cell and outside the solution of the cell is concentrated out. This process is repeated so that a proper balance between the solution concentration inside and outside the cell. Liquid filters used may be water, ethanol, methanol, ethanol-water or other solvents. Remaserasi means the addition of solvents after the first macerate filtering, and so on [20,21,27].

The studies mentioned above use an average of the samples (larvae) of 20-25 tail with 4-5 times the treatment. Larviciding said to be effective if it can turn off 90-100% of larvae test [22]. A compound is said to be active in the test larvicides with a maximum concentration of 1000 ppm. If you have an LC50 ≤ 500 ppm and said to be active if it has LC50> 500 ppm, whereas pure compounds said to be active and have bioactivity properties if it has LC50 ≤ 50 ppm and inactive if the LC50 > 200 ppm [23,25,26,27]. There are Several limitations to acknowledge in this review. Biological larvicides which contain essential oils, saponins and flavonoids effective as larvicides and extraction method most widely used is meserasi with ethanol solvent. There needs to be more research about the making of a good formula that can be

used by the people as larvicides. The authors would like to thank Universitas Airlangga for the funding support. Also Monika Noshirma, Ruben Wadu Willa at Loka Litbang P2B2 Waikabubak-Indonesia

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